the Department of Public Instruction of New South Wales, to accompany and explain the programmes for the mathematical classes in the high schools recently established in this State. Regret is expressed by the writer of that article that New South Wales "has been frightened by difficulties which were bound to arise in a period of transition, into going back to the old methods instead of boldly remedying the evil by helping all teachers to get the spirit of the new methods."

The point at issue is the treatment of the fundamental theorems of congruence, parallels, and the angle-sum for a triangle, in the course of deductive geometry given to pupils in these high schools. In the programmes, as issued, the teachers are advised to follow Euclid's method (or something of the same nature) in these fundamental theorems. The Board of Education circular, from which we have ventured to differ in this particular alone, recommends that these results be obtained by induction and experiment.

It seems proper that your readers should be aware of the following facts:—

(i.) The course of geometry in question is not meant for children of twelve years of age and under, as the writer of your article seems to assume.

Pupils enter these schools after completing a full course of primary education. Their age at entrance varies from thirteen to thirteen and a half.

(ii.) Before entering the high schools they have had a full year's work at geometry. In this preliminary study the newer methods are fully employed; the results are obtained by induction and experiment, and a great part of what the Board of Education circular recommends is adopted. However, the box of mathematical instruments does not hold sway to the entire exclusion of theoretical work.

(iii.) Although it has been thought advisable to ask for some uniformity of treatment in these early theorems in the deductive course, when this stage is past the fullest amount of freedom is granted.

There is no doubt that experience will show that some modifications in the syllabus are necessary. Some of the points mentioned in your article had already been noted as requiring alteration, and the suggestions which it contains will certainly receive the careful attention of the proper authorities. But the decision with regard to the earlier stages of the geometry course was made only after the fullest consideration. For this reason it is to be regretted that it has been, to some extent at least, misunderstood by the writer of your article.

Sydney, January 10. H. S. CARSLAW.

IN spite of Prof. Carslaw's assurance that pupils on entering secondary schools have reached the age of thirteen or thirteen and a half and have had a full year's work at geometry, the writer of your article feels most strongly that it is extremely unwise to impose on them in their first year at the secondary school a logical treatment of the fundamental theorems of congruence and parallels. Anyone who has had much experience of teaching pupils of that age knows how difficult it is to teach this work and how little impression it makes except on a very small minority; on the other hand, if these theorems are frankly assumed (after the pupils thoroughly understand their meaning) the rest of the geometry usually done in secondary schools can be treated logically, and the vast majority of pupils will get a proper grasp of the ideas of logical geometry. In the latter case the foundations are broad and the structure is firm at every stage; if the fundamental theorems are treated logically, an attempt is made to build on a narrower base, but in the majority of cases the lower stories of the structure are insecure.

The writer of your article must still regret the attitude taken up by the New South Wales authorities on this point. R. Y. S.

The Isothermal Layer.

IN reading Dr. Evans's reply to my letter in NATURE of January 25 with regard to the isothermal layer, I was specially interested in his reference to radiation of heat from orbital interplanetary matter as a probable climatic factor, because in *Symon's Meteorological Magazine* of February, 1911, I suggested that the recurrence year after year of warm and cold periods, first directed attention to by the late Dr. Buchan, may be attributable to modifications in a screen of cosmic matter, such, for instance, as that from which the zodiacal light and the Gegenschein are reflected.

I mentioned in a later number of that magazine that my own observations of the light in tropical latitudes, extending over several years, conveyed to me the impression of a ring of cosmical bodies encircling the earth about the zodiac.

For evidence of the isothermal layer at the equator the report of Prof. Borson on the aërological expedition of the Royal Prussian Aëronautical Observatory to East Africa in 1908[1] may be quoted. In this report at least two instances are recorded of balloon ascents near the equator in which the isothermal was reached: on August 30, at a height of 17·3 km., when a temperature of −82·5° C. was registered, and slightly lower temperatures at higher elevations; and on September 5, at 15·4 km., temperature −70·3° C., slight inversions being registered at greater altitudes.

The greater height of the isothermal in equatorial regions may be due to strong convection currents, as Mr. W. H. Dines supposes,[2] even though the origin of the layer be attributable to reflected heat from interplanetary matter. CAMPBELL HEPWORTH.

2 Amherst Road, Ealing, W., February 18.

St. Elmo's Fire.

ON Thursday evening, February 22, about 9.20 p.m., whilst traversing a country road which crosses the head of Carr Wood, a well-wooded clough in the neighbourhood of Heywood, near Rochdale, I was fortunate enough to witness a most unique phenomenon. The road in question skirts a hill on the left-hand side, and the opposite side, at this particular place, overlooks a small plateau which runs along the edge of the clough.

During the day we had had much rain. The atmosphere was now very close and heavy, and everything was ominously silent, even the usual *breeze having disappeared.* Suddenly, without the slightest warning, there appeared an area of faint electric-blue light, almost circular in shape and about 70 yards in diameter, which covered the plateau. The edge of this area was not more than 10 yards from where the observations were made. The whole electric field seemed to be three or four feet above the ground-level, and was in a state of intense agitation. Within the general blue ground there appeared flashes of a more decided blue, very similar in character to forked lightning, but not nearly so distinct.

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[1] "Results of Investigations of the Royal Prussian Aeronautical Observatory at Lindenburg." Edited by the Director, Doctor Richard Assman.

[2] "The Vertical Temperature Distribution in the Atmosphere over England, and some remarks on the General and Local Circulation." By W. H. Dines, F.R.S., Phil. Trans. Royal Soc., Series A, 211, page 269.

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Sounds of two distinct types accompanied the agitation. The first consisted of whistling sounds, like that of numerous long-lashed whips swishing rapidly through the air, or perhaps that of the whistle of bullets. These sounds seemed to be associated with the general field of fainter blue.

The other sounds consisted of the characteristic crackle of electricity, and these became so numerous as they approached the climax that they resembled a magnified rustle. These cracklings seemed to be associated with forked discharges, and were probably due to the more distinct flashes coming into contact with the bushes which surround the plateau.

The phenomenon lasted about fifteen to twenty seconds, and disappeared as spontaneously as it had arisen. J. McV. M.

The phenomenon described above appears to have been the luminous discharge known as St. Elmo's Fire. This takes place usually from pointed objects, and possibly the tree in your correspondent's sketch (not reproduced) played a part in the production of the phenomenon. The colour associated with St. Elmo's Fire depends upon the character of the discharge. It is blue when the earth is kathode and red when the earth is anode.

The discharge is not infrequent in mountainous countries. E. Gold.

Hampstead Garden Suburb, N.W.

Earthworms and Sheep-rot.

Everyone who is interested in agriculture is aware that liver-fluke or sheep-rot is popularly associated with one or another of our common plants. Halliwell gives "sheep-killing" as a name for "the herb pennywort." In Britten and Holland ("English Plant Names") we find sheep-rot, sheep-bane, and other similar terms, and we are told that such plants as *Pinguicula vulgaris*, L., and *Hydrocotyle vulgaris*, L., are known by these popular names because of a supposition that these plants cause the liver-rot in sheep, which disease is often prevalent on wet land where the plants grow. The authors further inform us that "It is now ascertained that the liver-fluke, which always accompanies rot in sheep, exists in one of its stages as a parasite in the bodies of small water snails, which, in wet weather, creep upon the leaves of marsh plants, and are eaten by the sheep with the herbage. It is therefore with some reason that such names as 'Flowkwort,' 'Sheep-killing Penny-grass,' and 'Sheep-rot' have been given to these marsh plants."

Withering ("British Plants") has a similar note. Speaking of Pinguicula, he says, "The plant is generally supposed injurious to sheep, occasioning a disease which the farmers call 'rot.' But it may be questionable whether the rot in sheep is so much owing to the vegetables in marshy grounds, as to a flat insect called a fluke (*Fasciola hepatica*), which is found in these wet situations adhering to the stones and plants, and likewise in the livers and biliary ducts of sheep that are affected with the rot. From experiments conducted with accuracy, it appears that neither sheep, cows, horses, goats, nor swine feed upon this plant."

During a recent visit to Cumberland, however, the matter was presented to me in a new light. I was conversing with a farmer on the economy of the earthworm, when my friend protested that they were responsible for rot in sheep. His explanation was as follows. The worms make casts in spring, known in the north as worm-sprouts, just as in the eastern counties they are called worm-puts. On these fine young plants grow rapidly, proving very attractive to sheep. When the sheep feed on this tender grass they are liable to suffer from fluke, and it is therefore maintained that the fluke, or rot, is in some way due to the earthworm.

It would be interesting to know more about this popular fancy, and to learn whether anything is being done to help farmers to a more correct knowledge of the facts. Hilderic Friend.

Swadlincote, Burton-on-Trent, February 17.

Meteor-showers.

I am sure that a great many of your readers who are interested in the subject of meteors have noticed the letters of Mr. John R. Henry which have appeared from time to time in your columns, but I do not recollect having seen any letter from an observer stating either that Mr. Henry's prediction had been fulfilled or that it had failed. If a shower of the thirty-third magnitude is sufficiently marked to enable three secondary maxima to be fixed with accuracy, one of the third magnitude, such as we are promised at the end of this month (February) ought to be very perceptible indeed. But perhaps the word "magnitude" does not refer to the number of the meteors but to their average mass. If so, how is this mass to be ascertained? Mr. Henry gives us no information as to the part of the sky in which these meteors should on each occasion be looked for. F.R.A.S.

Dublin.

"F.R.A.S." is right in surmising that the magnitude of a shower does not depend upon the number of meteors that may be actually observed, but rather upon the general mass or quantity of matter imported into the atmosphere at the time. This may appear to be a distinction without a difference, but as the number of shooting stars counted by an observer will be influenced by the altitude of the radiant, the clearness of the sky, &c., it is evident that the intensity of the phenomenon cannot be fully measured by such results. It is assumed that the radiant is the same as that usually associated with the time of the year at which the shower occurs.

To determine the absolute mass of a meteor-shower is a somewhat intricate problem, but it is possible to obtain an approximate solution of it by assuming that the portion of the meteor-swarm which enters the atmosphere is moving nearly parallel to the earth's surface, and in being brought to rest puts the surrounding air in motion. There must thus result an atmospheric depression, and given the mean depth and extent of the latter, the mass of the shower may be calculated from purely dynamical principles.

The order of magnitude does not express, as may be supposed, the absolute but rather the relative intensity of a shower, with reference to some other shower which may be regarded as the standard-shower. Thus of the two showers referred to by "F.R.A.S.," one of the thirty-third, and the other at the end of February of the third order of magnitude, the former is of the weakest and the latter of the highest intensity in the whole month. The greater meteoric event, apart from its high intensity, happens to belong to an interesting type or group of meteor-showers, one of which of the tenth order of magnitude occurred in 1908 on September 28, and another of the eighteenth order in 1911, on April 8–9, both occasions being marked by a magnetic and the latter also by a moderate seismic disturbance.

John R Henry.

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